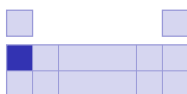


The Periodic Table

IGCSE Chemistry ▪ Topic 8

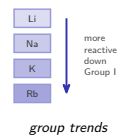
IGCSE Chemistry



The Periodic Table

What we will cover

- 1 How the elements are arranged
- 2 Group I – alkali metals
- 3 Group VII – halogens
- 4 Group trends & displacement
- 5 Transition elements
- 6 Group VIII – noble gases



1 Arrangement

The Periodic Table

Arrangement

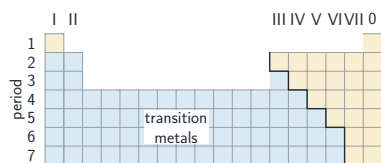
How the elements are arranged

- Across a period, the elements change from **metals** 金属 on the left to **non-metals** 非金属 on the right.
- The group number tells you the charge of the **ions** 离子 that the elements form. Group I forms +1 ions, Group II forms +2 ions, and Group VII forms -1 ions.
- Elements in the same group have similar chemical properties. This is because they have the same number of outer-shell **electrons** 电子, which is what decides how an element reacts.

The Periodic Table

Arrangement

How the elements are arranged, in detail



metals non-metals — metal / non-metal line

The group number tells you the charge of the **ions** 离子 that the elements form.

2 Group I and VII

Group I – the alkali metals

- Across a period, the elements change from **metals** 金属 on the left to **non-metals** 非金属 on the right.
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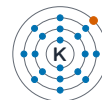
Group I – the alkali metals, in detail



lithium
2,1



sodium
2,8,1



potassium
2,8,8,1

every Group I atom has **one** electron in its outer shell (shown in orange), so they react in similar ways

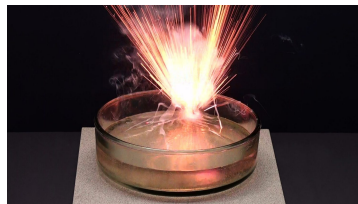
The group number tells you the charge of the **ions** 离子 that the elements form.

Reaction with water, and what you see

This is the reaction the exam asks about most.

- it **floats** - the metal is less dense than water.
- it **melts into a ball** - the reaction gives out heat, and the metal's melting point is low.
- it **moves about** on the surface - the hydrogen jetting off pushes it around.
- there is **effervescence** 泡腾 (fizzing) - the hydrogen gas escaping.

Group I reactivity



Group I elements are the **alkali metals** 碱金属: **lithium** 锂, **sodium** 钠 and **potassium** 钾.

They are **soft** 柔软 metals (you can cut them with a knife).

Sodium on water: what you would actually see

why it matters	"describe what you see" is worth marks of its own
it floats	sodium is less dense than water
it melts into a ball	the reaction is exothermic enough to melt it, and surface tension pulls it round
it fizzes and moves	hydrogen is given off, driving it across the surface
it gets smaller and disappears	as it is used up
the solution turns alkaline	universal indicator goes purple – it is now sodium hydroxide

The trend shows in how violent it is: **lithium** fizzes steadily but does not melt; **sodium** melts and darts about; **potassium** ignites the hydrogen with a lilac flame.

Group VII – the halogens

chlorine pale green gas	bromine red-brown liquid	iodine grey-black solid
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Halogens 卤素 are **diatomic** 双原子 non-metals (Cl_2). Down the group: density up, reactivity **down**.

Opposite group trends

- Group I: more reactive **down**
- Group VII: less reactive **down**

Metals lose electrons more easily lower down; non-metals gain them less easily.

Group I

Li
Na
K

↓ reactivity increases down

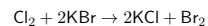
Group VII

Cl
Br
I

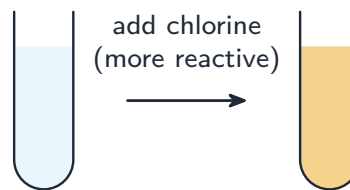
↑ reactivity increases up

Displacement reactions

A more reactive halogen **displaces** 置换 a less reactive **halide** 卤化物.



The released bromine turns the solution orange.



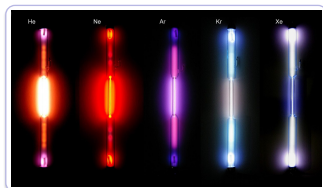
3 Other blocks

Transition elements and noble gases

transition elements 过渡元素
high density & melting point;
coloured compounds; cat-
alysts; variable oxidation
numbers ($\text{Fe}^{2+}/\text{Fe}^{3+}$)

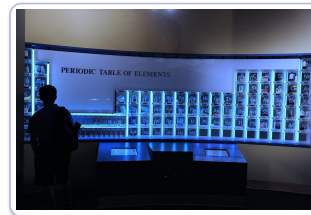
noble gases 稀有气体
Group VIII; **monatomic** 单原子
& unreactive – they al-
ready have a full outer shell

Group VIII – the noble gases



Passing electricity through each noble gas makes it glow a characteristic colour – this is how neon signs and other lights work

Arrangement of the elements



The periodic table arranges the elements in order of atomic number.

Transition elements



Transition metals form coloured compounds: each of these solutions contains a different transition-metal ion

Exam tips

- The Periodic Table is ordered by **proton number**. Elements in the same **group** (column) have the same number of outer electrons, so they react in similar ways; **periods** are the rows.
- **Group I** (alkali metals) get *more* reactive going down; **Group VII** (halogens) get *less* reactive going down – opposite trends.
- A more reactive **halogen displaces** a less reactive one from a solution of its salt – for example chlorine displaces bromine.
- **Noble gases** are unreactive because they have a full outer shell. **Transition elements** are hard and dense, form coloured compounds, act as catalysts and have variable oxidation numbers.

4

Recap

Worked example – predicting Group I behaviour

Predict how rubidium reacts with water, compared with sodium.

- Group I reactivity *increases down* the group.
- Rb's outer electron is *further from the nucleus* and more *shielded*.
- So it is *lost more easily* than sodium's.
- Rb reacts *more violently*, giving $\text{RbOH} + \text{hydrogen}$ – and the H_2 ignites.

Group I gets *more* reactive down (easier to *lose* an electron); Group VII gets *less* reactive down (harder to *gain* one). Opposite trends.

Topic 8 – key takeaways

1 Arrangement

by proton number; groups share outer electrons

2 Group I

soft metals; more reactive down the group

3 Group VII

diatomic; less reactive down; displacement

4 Other blocks

transition: coloured, catalysts; noble: inert

Check yourself

- 1 What does the group number tell you about electrons?
- 2 How does Group I reactivity change going down?
- 3 What state is iodine at room temperature?
- 4 Why are noble gases unreactive?



Answers 1. the number of outer-shell electrons 2. it increases 3. a grey-black solid 4. they have a full outer shell